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PRE-WAR UNEMPLOYMENT STATISTICS: A CRITIQUE

By Hornell Hart, *Iowa State University*

In the March (1922) number of this Journal,[1] W. A. Berridge states that "no writer on unemployment or on the business cycle has ever undertaken a rigorous quantitative analysis of the American data on unemployment." In a footnote he then refers to a monograph by the present writer, and says:

> Mr. Hart's study is comprehensive and highly laborious, but is unfortunately foredoomed to failure by the nature of the method employed. He seeks to measure the total volume of unemployment by subtracting the total "volume of employment" from the total "normal labor supply" in the United States. In both of these large quantities there are considerable errors of estimation, which of course assume a much greater relative magnitude when applied to the difference between the two quantities.

Inaccurate and misleading references such as these might well, under certain circumstances, be ignored. The monograph on *Fluctuations in Unemployment in Cities of the United States, 1902 to 1917*, has, however, been the only attempt at a quantitative study in this field, and has frequently been used by other writers as a basis for deductions. The article following Mr. Berridge's, for example, quotes its figures as authoritative. Inasmuch, therefore, as Mr. Berridge rejects the method on which those figures were based, and presents indexes of his own for the years 1903 to 1916 and 1919 to 1921 which he considers "fairly typical of industrial activity in this country" and which he believes "measure relative fluctuations in employment with high accuracy,"[2] the question of what figures should be accepted on unemployment for this period becomes worthy of attention by students of economic statistics and economic history.

In view of the fact that Mr. Berridge has put forth a "rigorous quantitative analysis of the American data on employment and unemployment," it is somewhat disconcerting to stumble upon misquotations and an incorrect reference in his footnotes, to find him using such expressions as "the coefficient of correlation was +85 per cent, 5 per cent lower than that between the two employment curves," and to note that he fails consistently to state the probable errors of his coefficients of correlation. Still more disconcerting is it to observe that in his weighted index of cycles of unemployment, which is apparently made up of deviations from trends, and which is headed "Unit:

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[1] Vol. XVIII, p. 42.

[2] *Rev. of Economic Stat.*, IV, p. 46 (Jan., 1922).

one standard deviation," the arithmetic mean of the series is +.15, and the standard deviation is .89, instead of being 0 and 1.0 respectively as one might expect. Such eccentricities make it rather difficult to put any intelligible interpretation upon the items in the index.

Technical inaccuracies are not, however, the essential objections to Mr. Berridge's pre-war unemployment index. Such errors are doubtless to be expected from inexperienced statisticians. The fundamental difficulties have to do with the essential unsoundness of his methods. In this article I shall undertake to make clear the following points:

1. Mr. Berridge's weighted index of unemployment for January, 1903, to June, 1916, correlates less closely with his own bureau's "Price Index of Business Cycles" for the same period than an index based directly upon the data used in my monograph published three and a half years earlier.
2. Correlation with any index of business cycles is not an adequate criterion of the value of an index of unemployment.
3. The elimination of seasonal variations from an employment index vitiates the index as reflecting employment conditions and is defensible only as a means of analysis. The final index should show actual fluctuations from all causes.
4. The use of the trend, as employed by Mr. Berridge, involves dangerous assumptions and leads to absurdities, which are avoided by the method used in my index.
5. The data upon which Mr. Berridge's index is based are a fundamentally biased sample, and cannot be trusted to reflect actual fluctuations of unemployment in the United States.

In January, 1922, Mr. Berridge published a table entitled "Cycles of Unemployment in All Trades and in Selected Trades in New York State, 1903–16."[1] In the discussion of that table he devoted a great deal of attention to the correlations between his index and various indexes of business prosperity. In November, 1921, his organization published "A Commodity Price Index of Business Cycles" which, the authors assert, "gives us an accurate record of the fluctuations of business and industry in general, exclusive of agriculture."[2] My monograph was published in May, 1918.[3] As one test of the relative soundness of Mr. Berridge's and my indexes, I have calculated, by the Pearson method, the correlation between Mr. Berridge's index and the deviations of the price index of business from its trend for the period covered by Mr. Berridge's index, and the correlation between my index for the same dates, in the form designated in the accompanying table as "C," and the deviations of the price index of business from its trend. The Berridge index correlates with the business index −.52 ± .04. My index correlates with the business index +.65 ± .03.

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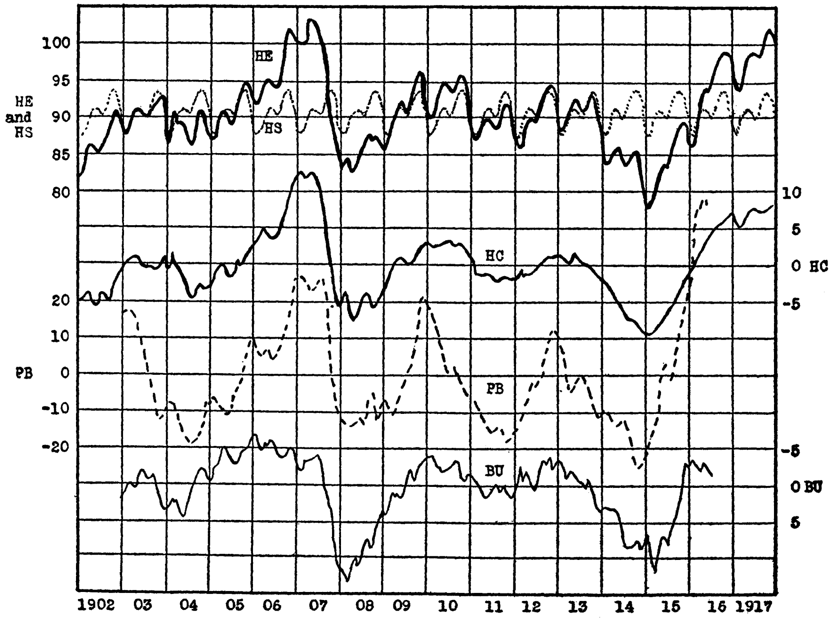
[1] *Rev. of Economic Stat.*, IV, pp. 46–49.

[2] Warren M. Persons and Eunice S. Coyle, *Rev. of Economic Stat.*, III, pp. 353–69.

[3] "Fluctuations in Unemployment in Cities of the United States, 1902 to 1917," Studies from the Helen S. Trounstine Foundation, vol. 1, pp. 47–59.

While these coefficients remove any basis for supposing that Mr. Berridge's index deserves to be substituted for data already in the field, correlation with business indexes cannot be considered an adequate criterion for judging the value of unemployment indexes. What should be sought in such an index is not a new means of measuring prosperity, but a reliable method of measuring the relative, and if possible the absolute, extent of unemployment at given dates, with a view to more accurate study of the problem, and ultimately the prediction of conditions at future dates. The number of persons unemployed is conditioned not only by the degree of general business prosperity but also by fluctuations in the supply of labor, by seasonal fluctuations in demand, by industrial disputes, and by other conditions. Prosperity and depression, moreover, act with different degrees of



NON-AGRICULTURAL PRE-WAR EMPLOYMENT AND BUSINESS CURVES

HE is Hart's percentage which the volume of non-agricultural employment constitutes of the normal labor supply. HS shows averages of HE by calendar months. HC is HE minus HS.
PB shows deviations of Pearson's Price Index of Business from its trend for the dates shown.
BU is Berridge's index of "Cycles of Unemployment" inverted.

rapidity on different employments and industries. The correlation between a perfect unemployment index and a perfect index of business prosperity would, therefore, be far less than unity. Mr. Berridge's interest in the business cycle has led him to eliminate and discard the seasonal fluctuations in his unemployment data, and he has ignored fluctuations in the supply of labor, with the result that his index does not reflect real employment conditions. The relative importance of seasonal variations may be seen in the accompanying chart.

The use of the trend by Mr. Berridge brings out a fundamental difference between his method and mine. The statistician in this field must cope with two fundamental problems: First, how he may secure reliable data on fluctuations in the volume of employment; and second, how these fluctuations may be turned into reliable measures of unemployment. In dealing with the second of these problems the United States Census of Manufactures has used the method of showing the relative numbers of persons employed in each month of the year of the census as compared with the month of maximum employment. This method ignores the facts that serious unemployment often exists in the peak month, and that population is constantly growing. A second method might be to measure deviations from a straight line drawn from peak to peak in the employment curve. This would ignore unemployment at the peaks and would make the false assumption of straight-line growth in the labor supply from peak to peak.

The solution which Mr. Berridge offers to this problem is to state his index of unemployment in terms of deviations from the trend. He seems to be under the delusion that he thereby avoids the necessity of making assumptions as to variations in the supply of labor. As a matter of fact, however, the use of the trend is in itself an assumption that the supply of labor is proportional to the ordinates of the straight line of closest fit to the curve of demand for labor. This is demonstrably untrue, and leads to absurdities. Changes in the supply of labor depend upon the birth rate, death rate, legal minimum age of employment, age of retirement from industry, immigration and emigration rates, and other factors. During the period of Mr. Berridge's index these conditions were changing at different rates, and in different directions. Migration, in particular, was fluctuating widely.

My own method of measuring unemployment was to build up a base line by means of careful estimates of changes in the supply of urban labor, and to state unemployment in terms of deviations in the demand for labor from this normal supply line. Mr. Berridge carelessly characterizes this method as "foredoomed to failure," but he does not escape the difficulty by substituting, for the supply of labor, the trend of employment as a base from which to measure deviations. He simply declines to use available knowledge to minimize error, and uses a crude base where a more exact one is available.

The absurdities to which the use of the trend lead are obvious from the fact that as new data are added the trend must constantly be altered. The trend employed in Mr. Berridge's index was valid for the period January, 1903, to June, 1914, but when he added two more years the trend did not fit. My method provides a base line which is not vitiated by the addition of subsequent data and which responds flexibly to every important change in the labor supply. Another difficulty with the trend is that it often represents factors which should be conserved instead of eliminated. There is good reason for believing that the trend in employment from 1903 to 1915 represents a real increase in unemployment; by eliminating such a trend Mr. Berridge falsifies the facts in which he is interested. Factors of this sort are conserved by the method which I used.

Mr. Persons uses a straight line trend in his price index chart of business cycles for the years 1897 to 1912, but apparently recognizes that the method is not valid for preceding and succeeding years. Indeed, the use of the trend here seems to be merely a crude and unsatisfactory method of eliminating the factor of inflation and contraction of the currency, just as Mr. Berridge's trend is a crude and unsatisfactory method of eliminating changes in the labor supply as a factor in unemployment.

Not only in the treatment but also in the selection of his data Mr. Berridge has failed to grapple adequately with the problem. His prewar index is based upon the reports of the percentages of union members unemployed, from six trades, representing "only one third or one fourth the total number of union members in New York State." In assuming that this index is "fairly representative of industrial unemployment in the country as a whole" he assumes that the returns themselves are reliable, that the unions reporting are typical of all the unions in these trades, that unemployment among union men is typical of unemployment among non-union men, that the six trades represented are typical of industry as a whole in New York State, and that New York State conditions are typical of the nation as a whole. All of these assumptions are questionable. The union men employed in railroading, for example, have entirely different employment fluctuations from the non-union men.

The data upon which my index is based include national statistics on manufacturing employment for every fifth year, national statistics on transportation, mining, and quarrying, and local data from nine representative states. It will not do to characterize this method as "comprehensive and highly laborious," and then fall back upon union reports for one class of labor in six trades in one state as a general index of unemployment. Elaborate technique is a vice unless used merely as the instrument of a worker having clear insight into the problem, for the analysis of sound and representative data.

The index of unemployment shown in the accompanying table is merely the best index yet available. It can be greatly improved, but its betterment depends upon greater comprehensiveness and thoroughness in the analysis of available data. Researches in this direction, now under way by other students, will doubtless soon supersede this index.

The above article was written before the second installment of Mr. Berridge's article in the June number of the JOURNAL was available.[1] In that installment Mr. Berridge has improved his previous pre-war index by adding data from Massachusetts and New Jersey, thus partially offsetting the criticism relating to the inadequacy of his basic data. It should be noted, however, that all of his materials are taken from three Atlantic coast states, and that he has still neglected important data relating to manufacturing in other sections of the country. Furthermore, although his results are labeled "General Indexes of

AN INDEX OF
NON-AGRICULTURAL EMPLOYMENT IN THE UNITED STATES
1902 TO 1917

E is the percentage which the volume of non-agricultural employment constituted of the normal supply of non-agricultural workers.
C is the deviation of E from the average of the series for that month.

Month	Average E	1902		1903		1904		1905		1906		1907		1908		1909	
		E	C	E	C	E	C	E	C	E	C	E	C	E	C	E	C
Average...	91	86	−5	91	0	89	−2	91	0	96	5	98	7	85	−6	91	0
January...	87	82	−5	87	0	86	−1	87	0	91	4	100	13	83	−4	85	−2
February..	88	83	−5	88	0	90	2	87	−1	92	4	100	12	84	−4	86	−2
March	89	85	−4	90	1	89	0	88	−1	94	5	101	12	84	−5	89	0
April......	91	86	−5	92	1	89	−2	91	0	95	4	103	12	82	−9	91	0
May......	91	85	−6	91	0	89	−2	90	−1	95	4	103	12	84	−7	92	1
June......	91	85	−6	90	−1	88	−3	89	−2	94	3	102	11	85	−6	91	0
July......	90	86	−4	90	0	86	−4	90	0	94	4	101	11	86	−4	91	1
August....	91	87	−4	91	0	87	−4	92	1	96	5	99	8	88	−3	91	0
September	93	88	−5	91	−2	90	−3	93	0	100	7	97	4	86	−7	94	1
October ...	94	91	−3	92	−2	91	−3	94	0	102	8	93	−1	87	−7	96	2
November	93	90	−3	93	0	89	−4	94	1	101	8	89	−4	87	−6	95	2
December .	91	89	−2	93	2	87	−4	93	2	101	10	85	−6	87	−4	94	3

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[1] "Cycles of Employment and Unemployment in the United States, 1903–14," Vol. 18, pp. 227–40.

Month	Average E	1910		1911		1912		1913		1914		1915		1916		1917	
		E	C	E	C	E	C	E	C	E	C	E	C	E	C	E	C
Average...	91	93	2	89	−2	90	−1	91	0	84	− 7	84	−7	94	3	98	7
January...	87	90	3	88	1	87	0	88	1	84	− 3	77	−10	86	−1	94	7
February..	88	90	2	86	−2	86	−2	88	0	84	− 4	78	−10	87	−1	93	5
March.....	89	92	3	88	−1	88	−1	90	1	84	− 5	80	− 9	90	1	95	6
April......	91	93	2	89	−2	89	−2	91	0	86	− 5	82	− 9	92	1	97	6
May......	91	94	3	90	−1	90	−1	92	1	86	− 5	83	− 8	94	3	98	7
June......	91	94	3	89	−2	90	−1	91	0	85	− 6	83	− 8	94	3	99	8
July......	90	93	3	88	−2	90	0	91	1	83	− 7	83	− 7	94	4	98	8
August....	91	94	3	89	−2	91	0	91	0	83	− 8	84	− 7	96	5	98	7
September	93	96	3	91	−2	94	1	93	0	85	− 8	88	− 5	98	5	100	7
October...	94	96	2	92	−2	94	0	93	−1	85	− 9	89	− 5	99	5	102	8
November	93	94	1	91	−2	94	1	91	−2	83	−10	89	− 4	99	6	101	8
December..	91	92	1	89	−2	92	1	88	−3	81	−10	89	− 2	98	7	99	8

Unemployment in the United States," he has ignored practically all of the data relating to employment fluctuations in occupations other than manufacturing.

Other criticisms are unaffected by Mr. Berridge's second installment. His failure to take account of fluctuations in the available supply of labor, and the fact that his method is so complicated that the resulting index cannot be interpreted in common-sense terms, are serious defects. He is to be congratulated, however, upon his vigorous attack upon a vital problem, and upon having raised important questions of technique in unemployment statistics.

A reply by Dr. Berridge to Dr. Hart's criticism has been received by the Editor, but too late for publication in this issue. It will appear in the December number of the JOURNAL.

PHYSICAL MEASURES AS FUNCTIONS OF FREQUENCY DISTRIBUTIONS

By M. C. RORTY

A point of view in connection with fundamental physical measurements which is of particular interest to the statistician arises from the very great probability that there are no absolute measures of extension, velocity, and time. Should this be the case, we are concerned, in physical mathematics, with measures which in every case must be derived from the things to be measured. If, for example, we are dealing with velocities, it is obvious that they can be measured only in relation to certain fundamental existing physical velocities. Similarly as to ex-